

What is claimed is:

1. A foot flexion device for use by a patient, comprising
at least one boot comprising

a calf member having a heel end and a knee end and
constructed and arranged to support a calf portion of said patient's leg

a baseplate having a heel end and a toe end, wherein said calf
plate and said base plate are rigidly attached to one another at said
heel ends,

a footplate having a footplate toe end and a footplate heel end,
said footplate heel end being rotatably attached to said heel end of said
baseplate so that said footplate may rotate with respect to said
baseplate,

an inflatable bellows positioned between said baseplate and
said footplate such that inflation of said bellows causes rotation of said
footplate relative to said baseplate to effect flexion of said patient's foot
when said foot is disposed on said footplate,

securing structure constructed and arranged to secure said
patient's foot such that said footplate and foot move together,
a pump assembly for pumping fluid to said bellows to power movement of said
footplate,

a controller operatively coupled to said pump assembly by at least one sensor
constructed and arranged to sense and transmit a sensor signal from a
muscle of said patient to said controller,

wherein said controller is constructed and arranged to receive said
signal and pause said pumping when said signal indicates that said muscle is
contracting spontaneously or irregularly.

2. A foot flexion device according to claim 1, further comprising at least one switch operable by an operator or by said patient, wherein said switch is constructed and arranged to send a switch signal to said controller to override or preempt said signal from said sensor to thereby pause said pumping.

5 3. A foot flexion device according to claim 1, wherein said sensor signal is electrical.

4. A foot flexion device according to claim 1, wherein said electrical signal is at least 500 microvolts.

10 5. A foot flexion device according to claim 1, wherein two boots are provided, each boot having a bellows connected to said pump.

15 6. A foot flexion device according to claim 1, wherein said fluid enters and exits said bellows by means of a tube connected between said pump and said bellows.

20 7. A foot flexion device according to claim 1, wherein said pump assembly and said controller are connected to said boot only by said tube so that said boot is physically and electrically isolated from said said pump assembly and said controller.

25 8. A foot flexion device according to claim 1, wherein said at least one sensor is an electromyogram lead and wherein said controller is electrically isolated from said patient and from said boot.

9. A foot flexion device according to claim 1, wherein said controller is programmed to restart from said pause following a period of electrical silence from said sensor.

5 10. A foot flexion device according to claim 9, wherein said electrical silence is the detection of no electrical signal greater than 100 microvolts.

10 11. A foot flexion device according to claim 9, wherein said controller is adjustable to restart said pumping following a period of electrical silence of from 1.0 to 5.0 minutes.

12. A foot flexion device according to claim 1, wherein said pump assembly and said controller are adjustable to inflate and deflate said bellows from 1.0 -20.0 cycles/minute.

15 13. A foot flexion device according to claim 1, wherein said fluid comprises one or more gasses selected from the group consisting of air, nitrogen, oxygen and carbon dioxide.

20 14. A foot flexion device according to claim 1, wherein said fluid comprises one or more liquids selected from the group consisting of water, isotonic saline, saltwater and oil.

25 15. A foot flexion device according to claim 1, wherein said fluid comprises a mixture of one or more gasses selected from the group consisting of air, nitrogen, oxygen and carbon dioxide, and one or more liquids selected from the group consisting of water, isotonic saline, saltwater and oil.

16. A foot flexion device according to claim 1, further comprising a pressure release valve to prevent over-inflation.

17. A foot flexion device according to claim 1, wherein said structure constructed and arranged to secure the patient's foot to said footplate is one or more selected from the group consisting of hook and loop fasteners, straps and buckles, tensioned fabric, and at least a portion of a stocking affixed to the footplate.

18. A foot flexion device according to claim 17, wherein said means constructed and arranged to secure the patient's calf to said calf member of said boot is one or more selected from the group consisting of hook and loop fasteners, straps and buckles, tensioned fabrics, and at least a portion of a stocking affixed to the calf member.

19. A foot flexion device according to claim 1, wherein said boot is constructed and arranged to allow attachment of said boot to the footrest of a wheelchair or similar assistive device.

20. A foot flexion device according to claim 1 wherein said boot may be incorporated into a receptacle or other such housing which can be placed on the floor to allow seated patients to benefit from the device.

21. A foot flexion device according to claim 1, wherein said boot is operable while submersed in a therapeutic liquid.

22. A foot flexion device according to claim 1, wherein said therapeutic liquid is one or more selected from the group consisting of water, aqueous solutions of therapeutic substances, aqueous salt solutions and therapeutic oils.

23. A foot flexion device according to claim 1, wherein said boot is constructed and arranged to be disposed distal to the knee of said patient when in use.

5 23 24. A foot flexion device according to claim 1, wherein the point of rotatable attachment of said footplate heel end to said baseplate is adjustable so that said foot flexion device may be specifically fitted to said foot of said patient.

10 24 25. A foot flexion device according to claim 1, wherein said boot is provided with adjustable means constructed and arranged to effect dorsiflexion of said patient's foot within a range controllable by said adjustable means.

15 25 26. A foot flexion device according to claim 24 wherein said range is from 1 degree to 30 degrees.

20 26 27. A foot flexion device according to claim 1, wherein said controller is adjustable to operate within a range of inputs from said at least one sensor.

23 28. A foot flexion device according to claim 1, wherein said controller is powered by a battery and said pump is powered by alternating current provided at a voltage between 100 and 250 volts.

28 29. A foot flexion device according to claim 1, further comprising means for stimulating the plantar area of said foot of said patient.

25 29 30. A foot flexion device according to claim 28 wherein said means for stimulating said plantar area is constructed and arranged so that said means operates when said footplate is fixed with respect to said baseplate or when said footplate is disposed to rotate with respect to said baseplate.

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30³¹. A foot flexion device according to claim 30, wherein said means for stimulating said plantar area comprises a plantar aperture in said footplate constructed and arranged so that, during inflation, a portion of said bellows protrudes through said aperture to effect stimulation of said plantar area of said patient's foot.

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30³². A foot flexion device according to claim 31, wherein said plantar aperture in said footplate is provided with a roller plate so constructed and arranged that, during inflation, a portion of said bellows displaces said roller plate through said aperture to effect stimulation of said plantar area of said patient's foot.

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33. A foot flexion device according to claim 1, wherein said controller can be operated by said operator by wireless remote control means.

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34. A foot flexion device for use by a patient, comprising at least one boot comprising

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a calf member having a heel end and a knee end and constructed and arranged to support a calf portion of said patient's leg
a baseplate having a heel end and a toe end, wherein said calf plate and said base plate are rigidly attached to one another at said heel ends,

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a footplate having a footplate toe end and a footplate heel end, said footplate heel end being rotatably attached to said heel end of said baseplate so that said footplate may rotate with respect to said baseplate,

an inflatable bellows positioned between said baseplate and said footplate such that inflation of said bellows causes rotation of said

footplate relative to said baseplate to effect flexion of said patient's foot
when said foot is disposed on said footplate,

securing structure constructed and arranged to secure said
patient's foot such that said footplate and foot move together,
a pump assembly for pumping fluid to said bellows to power movement of said
footplate,

a controller operatively coupled to said pump assembly by at least one switch
constructed and arranged to be operable by an operator to send a signal to
said controller,

wherein said controller is constructed and arranged to receive said
signal and pause said pumping when said signal is received.

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35. A foot flexion device according to claim 34, wherein said operator is said
patient.

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36. A foot flexion device according to claim 34, wherein said controller can be
operated by said operator by wireless remote control means.